Pbar Note # 607

The MCLENS Program(by S.O'Day and F.Bieniosek)

Documented by S.O'Day on 11/19/98.

The McLens program generates a fixed number of particles based on CASIM calculations done by Hojvat and VanGinneken. Absorption, secondary production and multiple scattering are accounted for in tracking these particles from the target through the lens and to a phase space ellipse which is matched to the Debuncher. The purpose of the simulation is to identify lens-AP2-Debuncher mismatch problems and to understand optimum target/lens geometry for different lens electrical parameters. This program resides on USER1:[oday] along with lcern1.com.

To compile and link McLens on ADCALC:

```
$ for mclens
$@lcern1  mclens
```

Lcern1.com should contain the following VMS commands:

```
$ SETUP CERN
$       define/nolog        IMSL_OLB  FERMI$ROOT:[LIBRARY]IMSL.OLB
$     define/nolog   PACKLIB_OLB
FERMI$ROOT:[LIBRARY.CERN.CURRENT.LIB]PACKLIB.OLB
$       define/nolog        MATHLIB_OLB
        FERMI$ROOT:[LIBRARY.CERN.CURRENT.LIB]MATHLIB.OLB
$       define/nolog        KERNLIB_OLB
        FERMI$ROOT:[LIBRARY.CERN.CURRENT.LIB]KERNLIB.OLB
$       define/nolog        PAWLIB_OLB
        FERMI$ROOT:[LIBRARY.CERN.CURRENT.LIB]PAWLIB.OLB
$ IF P1 .NES.  "" THEN GOTO LINK1
$ INQUIRE P1 "FILE NAME?"
$ LINK1:
$ LINK 'P1',IMSL_OLB/LIB,PACKLIB_OLB/LIB,MATHLIB_OLB/LIB, -
  PAWLIB_OLB/LIB,KERNLIB_OLB/LIB
```

To run, type:

```
$run  mclens
```

The values of the following namelist parameters will appear:

```
TPULSE = 360.1E-6                    ! Pulse length, sec
capacitance = 4.5e-3 ! Capacitance of capacitor bank (F)
```

```
GOUT = 0.675                    ! Lens timing
ZTL=.17                 ! dist. from target center to upstr. end of LL
rb0=.15                 ! RMS size of proton beam (mm)
MATL = 2                ! 1=W, 2=Cu, 3=Al, 4=73% Re
ZL=.07                  ! Target length
ZLL=.15                 ! length of li lens
EPX = 17.E-6        ! Acceptance(H) of collection optics (pi-m-rad)
EPY = 26.E-6        ! Acceptance(V) of collection optics (pi-m-rad)
voltage = 2342.             ! Charge voltage on capacitor bank (Volts)
IHBK= F     ! Make an HBOOK file to be read later
IHDO=F      ! Make ascii character HBOOK plots on screen
TD0 = 20            ! Target diameter (mm)
wire = .FALSE.              ! wire target=TRUE, slab target=FALSE
betax = 2.50        ! Beta function of AP2(H) at lens
betay = 1.50        ! Beta function of AP2(V) at lens
        Note: The offset parameters affect the particle creation point locations
              and angles. These offsets are required to obtain good agreement
              with data in Yield vs. Target-to-Lens-Distance curves for
              different voltages.
offsetx = 0.0           ! (h)Position offset from nominal zero (mm)
offsety = 0.0           ! (v)Position offset from nominal zero (mm)
       Note: offsetx=-.2 and offsety=-.3 produce maximum IC728 yield w/r to
             debuncher
offsetxp = 0.0          ! (h) Angle offset from nominal zero (rad)
offsetyp = 0.0          ! (v) Angle offset from nominal zero (rad)
       Note: ap2x,y,xp,yp are the phase space acceptance ellipse centroid
             offsets. These offsets are required to explain acceptance
             differences between AP2 and the Debuncher. Non-zero
             values indicate a phase space mismatch. Since pions and
             electrons are measured in AP2 while pbars are measured in the
             Debuncher, the mismatch may be only between particle species.
ap2xp=-1.
ap2yp=-1.5 for AP2 up to IC728
```

The values of any number of these parameters may be changed by typing:

&in parameter1=value1, parameter2=value2 &end <carridge return>

For example,

&in epy=10.E-6,offsetx=-1 &end

will change two parameters.

&in &end

will run with all defaults preserved and give the following output:

inductance = 2.8004592E-06 glens = 922.0746 cur0 = 766868.4
#total pbars accepted = 1020, # secondary pbars accepted= 154
#primary pbars generated= 31474, #secondary pbars generated= 9065
#pbars absorbed= 16922 + 850 = 17772, #pbars accepted outside rlens= 0
#unabs. pbars missing lens= 11798, #inc. protons missing target= 0
fraction of incident protons absorbed= 0.6353 normalized pbars= 648.

The output tells: how many primary pbars fell within the phase space acceptance ellipse, how many secondary pbars were accepted, how many primaries and secondaries were generated, how many pbars were absorbed, how many pbars outside of the lithium volume were eventually accepted, how many pbars missed the lithium volume, how many protons missed the target, the fraction of incident protons absorbed and the number of pbars normalized to target length. Note that the difference between the pbars generated and those accounted for tells how many pbars went through the lithium, but failed the acceptance ellipse test(i.e. the generated and accounted for numbers don't match when you add them).